

[COMMITTEE PRINT]

SPACE COMMERCIALIZATION

REPORT

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SPACE SCIENCE AND APPLICATIONS
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Honorable Don Fuqua, Chairman
Committee on Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

I am forwarding herewith this report on space commercialization issues that was prepared based on hearings held by the Subcommittee in May 1983.

This report first looks at broad space commercialization issues and then focuses on matters pertaining directly to expendable launch vehicles. The report does not address land-remote sensing activities. Dr. Gordon A. Smith, AIAA Congressional Fellow, prepared the report with assistance from Ms. Cyndy Short.

The work contained in this report is both timely and useful. I commend it to Members of the Full Committee and of the Congress.

Sincerely,


HAROLD L. VOLKMER
Chairman, Subcommittee on
Space Science and Applications

HV/Cvt
Enclosure

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1. INTRODUCTION

At the start of the ninety-eighth Congress, it was apparent that the commercialization of space was becoming a major consideration in the future of the United States civilian space program. Specific issues concerning the commercialization of land-remote sensing satellites and expendable launch vehicles (ELVs) became highly visible as a result of published, or pending, Executive Branch policy directives. It was appropriate, therefore, that the Subcommittee on Space Science and Applications of the Committee on Science and Technology study these space commercialization issues. It should be noted, however, that land-remote sensing issues are not addressed in this report. These concerns were taken up in separate hearings held jointly with the Subcommittee on Natural Resources, Agriculture Research and Environment.

This report documents the results of four space commercialization hearings held by the Subcommittee on Space Science and Applications in May, 1983. The objectives of the first two hearings were to acquire an understanding of the broad topics that characterize space commercial ventures, and to explore the need for any institutional and organizational changes in order to encourage commercialization. As Chairman Volkmer of the Subcommittee said,

Following the first successful operational flight of the Space Shuttle, our Nation stands on the threshold of a new era in space. To move forward and capitalize on our present strengths, fresh approaches have to be taken to provide opportunities for the American free enterprise system to use space for a variety of applications and technologies. We must ensure that the private sector has the freedom to organize and operate for profit in the space environment.

The third and fourth hearings held on May 3 and 4, 1983, focused specifically on the commercialization of launch vehicles, with the "Space Commerce Act" (H.R. 1011) providing the catalyst for the discussions. This Bill was introduced in the House of Representatives on January 27, 1983 by Congressman Akaka with the intention of providing encouragement and regulation necessary for the commercial development of space.

The timing of the hearings was appropriate. The May 3, 1983 hearing coincided with the publication of the National Academy of Public Administration's (NAPA) report entitled, "Encouraging Business Ventures in Space Technologies." This report was commissioned by NASA, and members of the NAPA Panel that prepared the report and Mr. Beggs, NASA Administrator, were included among the invited witnesses. On the second day, May 4, 1983, industry was represented for the purpose of hearing views on existing contractual instruments that are used by NASA to stimulate joint NASA/private sector space ventures.

Two weeks later, two hearings on the commercialization of space launch systems were held immediately following the May 16 White House news release that gave details of the Executive Branch policy on ELV commercialization. At the first hearing on May 17, 1983, testimony was given by Congressman Akaka, NASA, and the Department of Defense. On the following day, May 18, 1983, witnesses were drawn from companies that had expressed an interest in operating existing government ELVs or in developing new launch vehicles as commercial ventures.

The following two sections of this report summarize the witnesses' testimony, and discuss the major issues raised during the four days of hearings. The dominant theme was: Is commercialization feasible or desirable? If so, how do we accomplish it? Some of the issues that came up were: (1) the questions of which Agency in the Executive Branch should be the focal point or lead agency for ELV commercialization issues, and (2) whether there is a need for new legislation to foster space endeavors. There was concern for how the commercialization process in general can be streamlined and on what basis government property should be valued when transferring or leasing it to private sector organizations. Further questions were raised concerning the need for NASA to continue research and development activities in areas that have been commercialized and whether there would be competition for space payloads between Shuttle and commercial ELVs.

In general, these hearings were very informative. A cross-section of interested parties from both the public and private sectors was sounded for ideas and opinions and a number of constructive conclusions and recommendations emerged that are presented in Section IV of this report.

II. SUMMARY OF WITNESS TESTIMONY

The hearings on space commercialization covered a four-day period. Although there was a common base for all the hearings, the focus or perspective for each hearing was purposely directed to a particular facet of space commercialization. Therefore, this section deals separately with each hearing in presenting an overview of testimony given by the witnesses.

Space Commercialization Hearing on May 3, 1983

The witnesses who testified before the Subcommittee on May 3, 1983 were:

Mr. Philip M. Klutznick
Senior Managing Partner
Klutznick Investments
875 North Michigan Avenue
Chicago, Illinois 60611

accompanied by:

Mr. Mitchell Rogovin
Senior Partner
Rogovin, Hoge and Lenzner
1730 Rhode Island Avenue, N.W.
Washington, D.C. 20036

Mr. Gerald J. Mossinghoff
Commissioner of Patents
Department of Commerce
Washington, D.C. 20231

Hon. James Beggs
Administrator
National Aeronautics and Space Administration
Washington, D.C. 20546

Mr. Daniel J. Fink, Chairman
NASA Advisory Council
D.J. Fink Associates, Inc.
1901 North Fort Myer Drive
Arlington, Virginia 22209

The following is a brief summary of the testimony broken into three categories: that representing the views of the National Academy of Public Administration's Panel as reported in "Encouraging Business Ventures in Space Technologies"; testimony by NASA; and testimony from the private sector by Mr. Daniel J. Fink.

National Academy of Public Administration

Philip M. Klutznick. Mr. Klutznick, testifying on behalf of the NAPA Panel, expressed the opinion that the business community should explore space opportunities for economic benefit. "The Panel makes no predictions at this time as to the total benefits that might accrue from a commercialization thrust. Such estimates would be accompanied by great uncertainty. The Panel is convinced, however, that the space arena should be carefully and thoroughly examined by the business community so that, as a nation, we do not overlook an opportunity for economic benefit. Furthermore, the involvement of the private sector is essential to maintain U.S. leadership in space--an explicit national objective set forth in the National Aeronautics and Space Act of 1958."

Mr. Klutznick proceeded to emphasize that NASA is the principal generator of space technology and, therefore, must play a key role in facilitating the pursuit of economic benefits from space. To this end, "there must be a clear statement of senior management commitment and a positive program in support of commercialization as a policy compatible with the long-run future of NASA. This statement should be disseminated widely within NASA, to industry, and to the general public."

Neither should the emergence of a key role by the private sector in commercial space activities be a signal for a diminished NASA R&D role. "NASA is the basic source of space technology, space systems, and knowledge of the space environment, all of which are essential to support commercial endeavors in space. While industry excels in exploiting and marketing current technology, it often does not have the resources to undertake the high risk, long-term advanced developments necessary to maintain a leadership posture in an increasingly competitive international market."

"A case in point is the advanced satellite communications program in the NASA fiscal year 1984 budget request. The Panel believes that the continuing R&D role for NASA is vital if we are to identify new opportunities such as may exist in materials processing in space, referred to normally as MPS. For example, the NASA/McDonnell Douglas/Johnson and Johnson joint endeavor in electrophoresis, an experiment on the STS-6 flight, is based upon initial research performed by NASA. MPS appears to hold a large potential for economic benefit. The Panel recommends that NASA give more attention to this activity."

Furthermore, "Most space endeavors are recognized as high risk, expensive and long lead activities. These factors must be addressed if the private sector is to become involved. Technical risk can be reduced to more manageable levels through continuing NASA R&D activities that pursue new initiatives through technological demonstration."

As additional factors in reducing the expense of space experimentation, the Panel recommended continuing use of joint endeavor agreements and close coupling between NASA and the insurance industry "to assure available coverages for risk taking."

These are affirmative steps that NASA recognizes and which must be amplified by a policy of stability, consistency and continuity if business

enterprise is to be promoted. NASA also has the formidable task of making industry, particularly non-aerospace companies, aware of the potential of space technology. The NASA-developed cooperative mechanisms such as the industrial guest investigator program and the technical exchange agreement address this need and their use should be expanded.

To facilitate NAPA's recommendations, Mr. Klutznick, suggested, "the establishment of a well-defined focus of responsibility at a high level in NASA to address the commercialization role". He cautioned that this suggestion should not imply that a major reorganization of NASA is required, but rather a pulling together of appropriate organizational elements and the establishment of a focal point for commercialization activities.

In closing, Mr. Klutznick stressed that the Panel did not believe that its recommendations require a significant infusion of Federal funds. Rather, "our recommendations are to organize for a more efficient use of existing resources. Commercialization will require a government/industry partnership approach in which the private sector is expected to place capital at risk."

National Aeronautics and Space Administration

Mr. James Beggs. Testifying on behalf of NASA, Mr. Beggs began by saying, "The question that is being addressed today is no longer a question of whether space has commercial promise but, rather, how best to proceed and maximize that promise for national economic well being.

"Commercialization is not new to NASA. As we all know, we have had a number of very impressive successes in commercializing space technology. The most important, of course, is the commercial satellite communications industry which is now one of the fastest growing industries in the world and which has very impressively joined us with the rest of the world in a way that could not have been possible 25 years ago."

At the same time, Mr. Beggs conceded that there has been a problem in making non-aerospace industry aware of opportunities in space, both in the use of space shuttle and in the exploitation of NASA-developed technology. However, Mr. Beggs continued, "We are going to try to enhance and improve our ability to disseminate information to the non-aerospace sector, as well as to make them more aware from time to time of the opportunities that are available through the shuttle."

Mr. Beggs then pointed out that a mechanism called the Joint Endeavor Agreement (JEA) did exist which enables industry to enter into a joint undertaking with NASA. "It (the JEA) reduces the costs of the experimental phase of any commercialization idea, and it facilitates their (industry's) access to NASA technology. We are trying constantly to improve that mechanism."

Turning to another facet of space commercialization, expendable launch vehicles, Mr. Beggs told the Subcommittee that decisions encompassing the question of national security and the use of national launch facilities would be forthcoming later in the month. He concluded his prepared

statement by saying, "I cannot at this point predict the outcome of that study, nor the policy which we will recommend. But the activity is ongoing and I am confident that we will have a good policy very shortly that will enable our commercial friends to count on a stable situation if and when they desire to enter into agreements with us to commercialize those launch vehicles."

D.J. Fink, Associates, Inc.

Daniel J. Fink. While acknowledging that he is the current chairman of the NASA Advisory Council, and that the Council's deliberations would undoubtedly impinge on commercialization issues, Mr. Fink explained that he was drawing on his own experience for the basis of his testimony.

This experience and understanding of the market system led Mr. Fink to express the opinion that, "free enterprise implies both the elements of choice on the part of the private sector and the expectation that they will take the initiative in trading risk for reward. I call that private initiative, as it applies to space endeavors, 'commercialization pull.' When we have it, success normally follows closely in its wake." An example of successful 'commercialization pull' is the communications satellite business. This contrasts with the commercialization push of remote sensing by some parts of the government, "which certainly has been frustrating to the Congress."

Mr. Fink believes that commercialization push situations, in which interested private parties see the government as the principal customer, are little more than forms of contracting or funding, and are "not really the entrepreneurial engine that we all look to for expansion of our space endeavors."

In order to stimulate entrepreneurial ventures, action must be taken on all levels of government. "It is therefore vitally important that the policies now being developed to encourage commercialization be translated into actionable events by officials responsible for implementation. This is not a trivial statement because often these officials are many layers from the agency heads and are more used to the adversary contractual process than the cooperative efforts now demanded."

Mr. Fink did not specify a list of actions that had to be taken by government, but noted that resolutions had to be found to: "questions of government restraints on access to the market; controls on pricing, if any; and a much better understanding of the implications of national security overrides and their sensitivity to policy changes."

"There may be need for restraints on the government which proscribes them from future competition with the private entity and limits international agreements which create overseas competition. The costs of regulation must be understood and, most important, early negotiations are required on the costs of government facilities and services needed by the private sector with some guarantee of their stability over time."

"If these issues are handled in a business-like manner, I am very optimistic that there will be increasing private involvement in space activities, particularly where there is already commercialization pull,

such as in the provision of launch services through expendable launch vehicles."

In summary, Mr. Fink said, "I believe the United States has a unique opportunity to extend its leadership in space technology, science, exploration and applications through proper exploitation of government responsibilities and private sector initiatives. Clearly, the public policies are moving in this direction. My principal caution is that we recognize the complexity of the path on which we are embarking; that policy statements, while required, are not sufficient for success, and that much attention must be paid by all parties, private and public, in implementing the policies if we are to succeed."

Space Commercialization Hearing on May 4, 1983

The witnesses who testified before the Subcommittee on May 4, 1983 were:

Mr. David Hannah, Jr.
Chairman and Chief Executive Officer
Space Services Incorporated of America
P.O. Box 4
Houston, Texas 77001

Mr. Charles A. Ordahl
Director of Space Programs
McDonnell Douglas Astronautics Company
5301 Bolsa Avenue
Huntington Beach, California 92647

Mr. Bruce W. Ferguson
Vice President and General Counsel
Orbital Systems Corporation
664 North Michigan Avenue
Chicago, Illinois 60611

The focus of the second day of hearings on Space Commercialization was on NASA's cooperative agreements with private sector companies. A brief summary of the testimony is given below.

Space Services Incorporated of America

David Hannah, Jr., Mr. Hannah testified on behalf of Space Services Incorporated of America and identified three areas in which the government could provide added stimulus to promote space commercialization. These areas dealt with the regulatory path, the market, and the transfer of research and development between government agencies and the private sector. Each of these factors affected Space Services Incorporated when it was engaged in developing a commercial launch vehicle and acquiring a license to launch it.

The first area discussed was the need for "a clear-cut regulatory path, where we knew where we had to go and who we had to deal with, and what we were required to do...." Mr. Hannah went on to suggest that the achievement of this goal could be met most efficiently by establishing a

lead agency, and his recommendation for that role was the Federal Aviation Administration (FAA).

The second area in need of change, as indicated by Mr. Hannah, was the marketplace. "We feel that we can compete on a service and on an individual approach to a customer, in giving the kind of service that needs to be done. But we don't feel that we can compete with a subsidized program where we have to come in and compete with them at an artificial low cost of operation." The alternative would be to allow cost to be determined through the private sector versus using the artificial prices produced through government subsidy.

Finally, Mr. Hannah addressed research and development, in which his company found NASA to be "very helpful to us; anything that we have needed in the way of technology has been available to us." Mr. Hannah saw the need for NASA to continue to assist the private sector "past the research and development stage and into commercial application."

In conclusion, Mr. Hannah expressed the opinion that "if we had... a clear path of regulation, if we are not required to compete with a subsidized market, and if we have a clear path to research and development, we feel that we can continue to do a commercial operation, and do it effectively and do it on an economic basis."

McDonnell Douglas Astronautics Company

Mr. Charles Ordahl. Mr. Ordahl, testifying on behalf of McDonnell Douglas, focused his briefing to provide the Subcommittee "with information on our past and our current space launch vehicle commercialization activities and to share with the Subcommittee some of our views related to the government's roles and interfaces in these and future space commercial activities and ventures."

Mr. Ordahl outlined the programs McDonnell Douglas has developed over the last twenty years as contractors for NASA and the communications satellite industry. He referred to the Delta launch vehicle and the Payload Assist Module as projects which had "involved highly interactive activities between the industry and government within the structure of agreements between the parties involved."

The first commercial project undertaken by McDonnell Douglas was in 1973, when a decision was made to improve the performance of the Delta. At that time, as Mr. Ordahl pointed out, NASA was committed to the Space Shuttle, and no government funds were available to upgrade ELVs. However, the emerging domestic communications satellite industry was very interested in the cost effectiveness of the additional Delta launch capability. This set the stage for the first commercial space venture. RCA became the first customer and agreements were structured between RCA, McDonnell Douglas, and NASA.

The terms of this initial commercial endeavor involved four parts in which--

McDonnell Douglas agreed to design and develop the upgraded vehicle at their own risk using corporate funds but with profit limitations.

McDonnell Douglas agreed to recover its investment through a specified "not to exceed" customer charge for each commercial launch; however, there would be no "investment charge" for U.S. government use of the vehicle.

NASA agreed to contract for production and launch services of the Improved vehicle as an integral part of the ongoing Delta program and would provide technical monitoring.

RCA agreed to contract with NASA for three vehicles and launch services and with McDonnell Douglas for three user development amortization payments.

This agreement led to a successful Delta enhancement program that has resulted in 23 launches of the upgraded version.

The second commercial venture undertaken by McDonnell Douglas came in 1976 and involved the Payload Assist Module or PAM-D. Mr. Ordahl explained that the "PAM-D is an upper stage vehicle for Delta class satellites designed to assist launch vehicle customers in planning launches in the era of transition between expendable launch vehicles and the space shuttle." This type of vehicle is designed to provide the customer with the flexibility of planning a launch on either the Delta or the Shuttle.

The development of the PAM-D began after McDonnell Douglas and NASA reached an understanding in which:

McDonnell Douglas agreed to develop the complete system using its own commercial funds on a schedule compatible with the Shuttle operational requirements.

McDonnell Douglas agreed to sell PAM-D commercially at a specified "not to exceed" ceiling price along with a fixed escalation for inflationary factors in addition to profit limitations.

NASA agreed not to fund or formally solicit the development of competitive or alternate systems.

NASA agreed to provide suitable building facilities at Kennedy Space Flight Center for PAM-D processing activities with reimbursement as a part of the Shuttle launch service contract with each customer using PAM-D.

NASA agreed to provide interface data and technically monitor the project.

In 1978 the first commercial contract was signed between Hughes and McDonnell Douglas and to date, 29 contracts for PAM-Ds have been signed, and 10 PAM-Ds have already been successfully flown. Mr. Ordahl went on to emphasize that, "Sales of PAM-D are, of course, highly interlocked with the availability and pricing of Shuttle and Delta for commercial launches. To date, this has been generally favorable although several potential missions were lost to Ariane in the 1984-85 time period because NASA was not able to offer STS launches at the time these contracts were decided and Delta prices were not competitive. Subsequently, STS launch space is available in those particular years."

In conclusion, Mr. Ordahl emphasized that the commercial projects of McDonnell Douglas were designed not to compete with NASA, but to be compatible with the efforts of NASA. He also expressed the need for the government to encourage space commercialization through "favorable and stable allocation and pricing of government facilities and resources where such are used by commercial projects. Decisions by the government in these areas will be a substantial and increasing factor as the size and scope of space commercialization projects expand."

Orbital Systems Corporation

Mr. Bruce Ferguson, Testifying on behalf of Orbital Systems Corporation (OSC), Mr. Ferguson explained that OSC is presently engaged in the construction of the Transfer Orbit Stage (TOS), a project which will be achieved through agreements made with NASA and Martin Marietta Corporation. Mr. Ferguson identified this project as a positive step in space commercialization. "The evolution of the commercial satellite market to larger, heavier satellites indicates that an economical high-capacity upper stage such as TOS is well positioned to capitalize on a significant business opportunity."

Mr. Ferguson, went on to indicate the importance of the TOS and the development of the capability to use the vehicle effectively. "At present, there exists no economical way to launch large satellites of the TOS Class--Approximately 2,800 to 6,800 pounds--into Geosynchronous Orbit, other high orbits, or on planetary missions."

Furthermore, "the only publicly announced program to develop an economical launch capability for TOS-class payloads, in fact, is the European Ariane rocket program that competes directly with the Space Shuttle. NASA must provide a similar capability in order to remain competitive with Ariane for commercial payloads."

In recognition of the need for an economical, high capacity upper stage for use on the space shuttle, OSC reached an agreement with NASA to finance, develop, market and operate the TOS. In the terms of the agreement, OSC agreed to "develop the TOS using private funds at no charge to NASA, and NASA will provide technical monitoring out of its Marshall Space Flight Center in Huntsville, Alabama to ensure that the safety requirements of the Space Shuttle are met. NASA also agrees to provide certain interface data on the Space Shuttle and related facilities. No subsidies or purchase guarantees are involved."

Following a series of discussions with a number of major aerospace firms, OSC chose Martin Marietta Corporation as the prime contractor for developing and manufacturing the TOS. In the agreement reached between the two firms, Martin Marietta would be responsible for "performing most of the design, development, testing and production of the TOS hardware and managing TOS subcontractors. For its part, OSC will have primary responsibility for financing and marketing the TOS. The first TOS is expected to be available for launch by the fall of 1986."

In reaching these agreements, Mr. Ferguson acknowledged that OSC had been given "the full support of NASA's top officers in its efforts to establish the TOS program." Such support, he went on, "is a vital prerequisite to future progress in space commercialization." Mr. Ferguson also stressed the importance of the agreement made between OSC and Martin Marietta Corporation, calling it "a marriage of the entrepreneurial energy of a small firm with the technical and production resources of a large aerospace company". These types of agreements are vital to the future of space commercialization.

In conclusion, Mr. Ferguson expressed the opinion that, "To the extent that NASA and this Committee support projects with a high likelihood of success in a few years, public perception of space commercialization as a new sunrise industry will inevitably increase the number of high quality projects and available private investment. Cooperative arrangements between NASA and private firms, we have found, are an effective means of demonstrating NASA's support for such projects, and should continue to be implemented where practicable."

Commercialization of Space Launch Systems

The space commercialization hearing that took place on the third day of hearings focused on the potential of commercializing space launch vehicles. The witnesses who testified before the Subcommittee on May 17, 1983 were:

Hon. Daniel K. Akaka
U.S. House of Representatives
Longworth Building - Room 1007
Washington, D.C. 20515

Lt. Gen. J. A. Abrahamson
Associate Administrator for the
Office of Space Flight
National Aeronautics and Space
Administration
Washington, D.C. 20546

Mr. Herbert A. Reynolds
Deputy Director for Intelligence and
Space Policy
Department of Defense
The Pentagon, Room D 239
Washington, D.C. 20301

Congressman Daniel K. Akaka

Hon. Daniel Akaka. Mr. Akaka emphasized the need for formulating a policy to deal with the long-term future of our space programs. He began his testimony by identifying the certain risks involved such as, "turning over to the private sector a capability which the government may need as a back-up to the Space Shuttle. What happens if, at some point in the future, the private sector cannot deliver backup launch services when needed?"

"Can national security interests continue to be protected if launch systems are commercialized? Should the Federal Government be willing to take the risk for possible damages to a third party stemming from a failed commercial launch, as it is required to do under the 1967 Outer Space Treaty? And, finally, there is the important question of the extent to which commercialization of ELVs may take potential payloads away from the government-developed shuttle."

In addition to these government concerns, Mr. Akaka outlined the concerns of the private sector, such as, whether the Shuttle pricing policy might change making it impossible to compete with the government; or the fear of DOD usurping commercial payloads. Based upon the alternatives and the rise of competition with the Ariane, Mr. Akaka feels the risks are worth taking and, "to this end, I introduced H.R. 1011, the Space Commerce Act, as a logical first step in confronting these issues."

Mr. Akaka's aim in introducing this bill was to provide a procedure by which industries may enter into the commercialization of space without having to deal with six to eight agencies, a process which wastes both time and money. In his bill, Mr. Akaka named the Department of Commerce as the lead agency. "As a third-party agency, Commerce is an obvious choice. It has a charter which permits this type of activity and, more importantly, when we talk about space-launching services, we are talking about business, about commerce, and about trade.

In Mr. Akaka's opinion, the Department of Commerce would provide a proper business and regulatory interface for the private sector, and he mentioned that he had "always made the point that a Bureau of Commercial Space activities should be created at Commerce, tapping the agencies in which the experts now work--NASA, State, DOD, FCC and FAA, for its own staff." This, he believes, may be achieved through legislative authorization, reprogramming, and little additional funding.

Next, Mr. Akaka gave his support for the commercialization of the Space Shuttle. He said, "NASA is an R&D agency by design and statute. In the long term, commercial operations do not belong in NASA, unless we redefine the mission of the agency." Furthermore, a lot of money has been invested in the Shuttle program, and in order to reap the benefits, he believes the marketing of the Space Shuttle belongs in the hands of the private sector.

Finally, Mr. Akaka expressed his concern about the rise of international competition in space launches. "Today, in addition to the Europeans, China, India and Japan are in various stages of developing and

perfecting their own launch vehicles. And the Soviet Union has shown interest in offering commercial launches as well. The fact is that the world marketplace for launch services has become competitive.

"If we, as a Nation, are to respond to this challenge, we must change our way of thinking about the role of the Government and the private sector in space. We must be able to forge a true partnership between public and private interests in space and we must not fail to create a climate conducive to private sector investment in space."

NASA, Office of Space Flight

Gen. Abrahamson: Testifying on behalf of NASA's Office of Space Flight, Gen. Abrahamson pointed out that his office has been significantly involved in the evolution of commercial activities in space. He expressed the belief that "the full promise and the potential benefit of space activities can only be realized as we harness the engine of commercial enterprise, in partnership with our government efforts. In a proper and mutually rewarding relationship, this partnership will assure continued U.S. leadership in space."

NASA's goals, as stated in the Administration's National Space Policy, call for the expansion of the private sector in both investment and involvement. General Abrahamson pointed out that, "through joint endeavor agreements, technical exchange agreements, and our industrial guest investigator process," NASA is attempting to create the appropriate cooperative relationships needed between the private sector and the government.

Gen. Abrahamson referred to the discussions that NASA has already engaged in with the private sector regarding space commercialization proposals. These proposals and endeavors serve to add a new dimension to the space program, and he said that, "some people and institutions involved are tackling very significant development risks as well as market risks. Therefore, in these instances, it is appropriate and consistent with NASA's technology mandate to provide the assistance and encouragement that our joint endeavor and other agreements provide.

"By the same token their success adds to the capability of the STS, while avoiding the requirements for federal funding. So long as we can proceed on this approach equitably and properly, this is the powerful mutual reinforcement of government and private efforts that I feel can assure U.S. space leadership."

At the present time NASA has found that it is not yet ready to relinquish the day to day operation of the Space Shuttle. However, this does not rule out the possibility of handing over Shuttle operational activities to industry in the future when the Space Shuttle program has "reached a sufficient state of maturity." To date, NASA has received proposals concerning the building of a fifth orbiter, as well as proposals to take over the marketing function of the STS. Once again, Gen. Abrahamson expressed the opinion that although these are feasible options for the future further policy evaluations are necessary before any decisions are made.

Gen. Abrahamson went on to express his support for "the recent announced policy concerning the private sector operation of the Expendable Launch Vehicles currently operated by the Government. There is a reasonable question about the potential impact of such an action on the Space Shuttle.

"Although I am naturally concerned about the competition, the policy establishes a clear operating framework with respect to the STS and the commercially operated Expendable Launch Vehicles."

In conclusion, Gen. Abrahamson restated his support for the commercialization of space. He assured the Subcommittee that, "we intend to continue our efforts to increase the involvement of the U.S. private sector in civil space activities with a view for the national economic benefit and to fully exploit the capabilities of the Space Transportation System."

Department of Defense

Mr. Reynolds. Testifying on behalf of the Defense Department, Mr. Reynolds gave the Subcommittee a report on the views held by DOD concerning the commercialization of space and, specifically, the commercialization of ELVs. These views were based on 18 months of government space policy studies that produced three important documents: the National Space Policy, the Department of Defense Space Policy, and the policy on the Commercialization of ELVs.

In regard to the ELV commercialization policies studied by a Senior Interagency Group (SIG), "it was the Group's unanimous conclusion that the U.S. Government should fully endorse and facilitate the commercialization of ELVs.

"It was further agreed that the U.S. Government should not subsidize this activity but should structure the agreements for use of its facilities, equipment and services consistent with the goal of encouraging viable commercial ELV launch activities.

"The President's Commercial ELV policy reaffirms the existing U.S. Government commitment to the Shuttle and the intent to make it available to all users--domestic and foreign, commercial and governmental--subject to U.S. Government needs and priorities."

As a result of these policies, DOD will enter a transitional phase in which all DOD payloads will be Shuttle optimized. Due to this transition the decision has been made "to discontinue future procurement of Titan launch vehicles." This policy was formulated because, "Within the DOD, we believe that the Shuttle will prove adequate for routine launch activities. We view the commercialization of ELVs as a potential means to maintain an expendable launch vehicle production and launch capability at little or no cost to the DOD that could contribute to the goal of achieving a more robust capability to place payloads in orbit."

A second area in which Mr. Reynolds felt that the commercialization of ELVs would benefit the Defense Department was in regard to technology transfer. He expressed the opinion that "If U.S. commercial ELVs are not available and the satellite market expands beyond the capabilities of the STS and Ariane, a market for additional ELVs will be created. This market could be serviced in ways detrimental to our security. We must always remain aware of the fact that space launch systems have inherent military applications." Other benefits mentioned by Mr. Reynolds included the "enhancement of the economy, creating jobs, expanding the tax base of the U.S. and a number of states, and improving our international balance of payments."

The DOD is supportive of commercialization of space from the standpoint of the incentives mentioned above; incentives which would be built around the increased activity of the private sector in the commercialization process. Another favorable aspect in the commercialization of ELVs would be the availability of production and launch facilities presently owned by the U.S. Government.

Mr. Reynolds said that, "These residual facilities and equipment will have little value to the U.S. government but considerable value to a U.S. commercial ELV industry." Furthermore, "The sale or lease of these items would reduce agency budgets for production close-down and disposal of assets." This situation could benefit both the U.S. government and the industries who chose to enter the ELV market.

In summary, Mr. Reynolds said, "We support the President's Policy on the Commercialization of Expendable Launch Vehicles by the U.S. private sector. The existence of such a capability will provide the basis for a more robust space launch capability and could support future developments to satisfy unique national security requirements."

Commercialization of Launch Systems

The purpose of the final hearing was to air the major issues that concern the private sector in regard to the commercialization of space launch vehicles. The witnesses testifying before the Subcommittee were:

Mr. Gary Flora
Space Launch Systems Division
Martin Marietta
P.O. Box 179
Denver, Colorado 80201

Dr. Klaus Heiss, Former President
The Space Transportation Company, Inc.
22 Chambers Street
Princeton, New Jersey 08540

Mr. Allan McArtor
President & Chief Operating Officer
FEDEX Space Transportation Company
889 Ridge Lake Blvd.
Memphis, Tennessee 38119

Mr. William F. Rector, III
 Vice President and Director of Space Programs
 General Dynamics Convair Division
 P.O. Box 80847
 San Diego, California 92138

Mr. James C. Bennett
 Vice President for Government Affairs
 Arc Technologies
 837 2nd Avenue
 Redwood City, California 94603

Martin Marietta

Mr. Flora. Testifying on behalf of Martin Marietta, Mr. Flora expressed his company's support for the development of space commercialization, but at the same time urged the government not to delay the policy making process.

Mr. Flora stressed the value to national security of maintaining a stable of ELVs. For example, the Titan would be able to "provide a backup capability to the Shuttle for certain national security payloads." In addition, the "Titan will provide a backup capability to the Shuttle for non-military payloads in the event of schedule delays or priority DOD missions. Moreover, Titan will provide domestic supplementary launch capability during periods of peak civil and military demands, as well as launch capability for hazardous payloads and payloads that are neither technically nor economically feasible to upgrade to man-rated standards."

Mr. Flora assured the Subcommittee that the commercialization of the Titan would not create a competitor for the Shuttle, but rather a backup which would compete for payloads that exceed the capacity of the Shuttle. The Titan would, however, compete with the Ariane, thereby helping to keep the U.S. space program in a position of space leadership. In addition, the continuation of the Titan program would save "approximately 6,000 jobs for 220 Titan suppliers in 25 states."

In regard to Martin Marietta's efforts to commercialize the Titan, Mr. Flora explained that a market analysis showed positive results and encouraged his company to prepare a bid to the International Telecommunications Satellite Organization (INTELSAT) for the launch of their INTELSAT VI satellite series. "Our proposal to INTELSAT involves a bid for the launch of two satellites, designed to be a complement to the Shuttle and a direct competitor to the Ariane. Production of the Titan vehicles will begin in 1983 and they will be available for launch in 1986. Our belief is that INTELSAT will select the Shuttle as well as one expendable launch vehicle to implement their total launch strategy."

Mr. Flora pointed out that the success of Martin Marietta's bid to INTELSAT will play a major role in the decision to move forward with the commercialization of Titan, but in the meantime, "We are encouraged to hear that the President has approved a new Space Policy encouraging private

sector entry into the expendable launch vehicle business." Mr. Flora went on to say, "Our understanding is that the policy states clearly that the U.S. Government will encourage and facilitate the licensing and/or use to the private sector of those expendable launch vehicle systems that it previously operated. This support will include designs, tooling, ground support equipment, facilities and property that are being phased out. The policy states that government will not seek to recover sunk costs. Moreover, the policy encourages and facilitates the use of national ranges by the private sector."

In reference to H.R. 1011, the Space Commerce Act, Mr. Flora supported it because "it encourages the private sector to pursue expendable launch vehicles as a business venture." However, he pointed out that "there are some issues that the Act omits. The Act does not direct DOD and NASA to allow private sector use of any government launch facilities. Nor does it encourage the DOD and NASA to allow use of government design and tooling without recapturing sunk development costs. Finally, there does not seem to be adequate safeguards that will prevent premature launch attempts without sufficient development and testing of the launch vehicle system."

In conclusion, Mr. Flora asserted that Martin Marietta believes that "the United States would be well served by the development of a commercial space industry. The actions that the government needs to take involve little or nothing in the form of budget outlays, but what actions are required must be taken quickly. The companies involved in commercial space technologies cannot afford long delays in government policymaking or implementation. Production lines and key personnel involved will be lost if commercialization is not successful in the very near future."

Space Transportation Company, Inc.

Dr. Helss. In presenting a summary of his views concerning the question of commercial space transportation, Dr. Helss began by announcing that SpaceTran has entered into an agreement with Federal Express; "an agreement in which the commercial activities [of SpaceTran] are turned over to FEDEX, a subsidiary of Federal Express."

Dr. Helss went on to identify his experience with the space program which began in the late 1960s when he directed the economic studies that led to the consideration of the Space Shuttle. In the mid 1970s he was involved in formulating the economic principles that were, "to underlie the Space Shuttle user charge policy for NASA." Then, in 1979, Dr. Helss "founded the first United States company whose sole objective it was to bring about private organization and financing of space transportation systems." Since then Dr. Helss has been "active in the market-based initiatives of both the Space Shuttle and the Titan."

In identifying the issues and opportunities surrounding the commercialization of space, Dr. Helss suggested that the private sector be

responsible for funding of an additional Space Shuttle orbiter and not the taxpayers. Secondly, Dr. Helss then questioned whether one should, "create a government monopoly in U.S. space transportation or should one follow a market oriented, competitive approach between any U.S. space launch systems willing to risk private funds in commercial enterprises." Further, he asked, "can and should ELVs compete with the Space Shuttle in the world space transportation markets, and why? And finally, what are economically efficient roles for commercial ELVs and the Space Shuttle system to fairly--and efficiently--compete in World markets in the 1980s and the 1990s.

FEDEX Space Transportation Company

Mr. Allan McArtor. In his testimony on behalf of Federal Express, Mr. McArtor explained that the merger between Federal Express and SpaceTran gave Federal Express 100 percent of SpaceTran's commercial Titan program. "We took this step in order to present INTELSAT with the best possible proposal for launch services of INTELSAT VI spacecraft."

As a subsidiary of Federal Express, Mr. McArtor pointed out that FEDEX SPACETRAN does not intend to replace or absolve the government of its responsibilities in space operations. Instead, "We feel it is particularly appropriate for Federal Express to not only be involved in commercial space operations but to assist the government and the industry in developing appropriate policies, procedures, and controls so that this new frontier can provide new opportunities to those bold enough and imaginative enough to pursue them."

Mr. McArtor was quick to point out that, "FEDEX SPACETRAN is not, however, a traditional 'aerospace' company and hence not burdened with a vested interest in a particular piece of space hardware. Rather, FEDEX SPACETRAN is a service company--able to look at the user community objectively and to provide services that are totally responsive to their needs. The industry is being told that this capability is needed.

"Long-range plans of FEDEX SPACETRAN might include launch services and marketing services for Shuttle and ELVs, development and marketing of upper stages, financial and insurance programs, payload logistics, and other related services."

In addressing the role of the government in a commercialized space industry, Mr. McArtor maintained that "the government should provide, maintain, and operate launch facilities and ranges just as it does with harbors, canals, bridges, airports, highways, and other transportation 'bases' that allow the commercial operator to access this 'base' under some appropriate but not burdensome user fee basis."

Furthermore, "The government should encourage private initiatives in space through tax incentives, loan programs, or even guarantees. Again parallel to other initiatives in this nation."

In addition, Mr. McArtor saw a need for a new Interagency group, "with the authority to develop appropriate oversight controls and to implement the government's commercial space program." A new group is required because no single agency possesses all the skills necessary to become a lead agency at this time.

In conclusion, Mr. McArtor reiterated that the government must be responsive to the needs of the "space user" community if the United States is to retain its supremacy in space. It is his opinion that this community, "has already expressed the necessity for a viable Space Shuttle program plus a reliable ELV, a broader based finance and insurance pool, and a streamlined process for assessing the space transportation network."

General Dynamics Convair Division

Mr. Rector. Testifying on behalf of General Dynamics, Mr. Rector focused on launch vehicle issues and began by outlining the role that General Dynamics has played in the U.S. space program. Since 1957 General Dynamics, which builds the Atlas and Centaur upper stage, has launched 471 Atlases for various programs. "To date, 69 commercialization satellites have been launched by the United States, and one-third of these have been on Atlas Centaur."

In addition to their commercial Satellite program, Mr. Rector said that General Dynamics has also contributed to the Space Shuttle program. "We designed and built the mid-fuselage for the Space Shuttle orbiter and just delivered the OV-104 for the Atlantis two weeks ago. We are modifying the Centaur for use as an upper stage in the Space Shuttle for the NASA planetary missions Galileo and International Solar Polar Mission."

The outline Mr. Rector provided served to show General Dynamics' belief in the need to commercialize ELVs. As General Dynamics sees the situation, between 1986 and 1995 there may be a need to provide launch services for 245 commercial communications satellites. This prediction indicates a much higher demand for these services than models produced in the early 1970s when a decision was made to rely entirely on the Space Shuttle. "These commercial communication launch service requirements present a classical supply deficiency which has always offered the private sector an incentive to participate."

Mr. Rector pointed out that the European Ariane is a "formidable competitor to the U.S. and is capturing much of this overflow due to aggressive marketing, creative financing, and so on. We believe that Ariane should not be allowed to take over the ELV business unchallenged."

In addition to warding off competition from the Europeans, ELVs could also provide a backup to the Space Shuttle. As Mr. Rector said, "Successful commercialization of the ELVs will create some offloading of the Space Shuttle manifest, which will provide the opportunity for using its unique properties--its size, the use of man, and its servicing and retrieving capabilities." He went on to say that "We believe that co-existence of both the space shuttle and the U.S. ELVs will be beneficial in that both systems will operate more competitively and therefore more efficiently."

Mr. Rector concluded by saying that the [May 16, 1983] space policy on ELV commercialization was a step in the right direction. "We are very pleased with this event, and believe it provides the basis to

proceed. We look forward to an expedient action and implementation of the necessary agreements to allow the take-over of the tools, facilities and equipment to manufacture, test and launch the ELVs. It is needed to avoid the loss of industrial base necessary for ELVs and to meet foreign competition."

Arc Technologies, Inc.

Mr. Bennett. Testifying on behalf of Arc Technologies, Mr. Bennett explained that Arc Technologies is a company at one end of a spectrum because it is a company which "seeks to provide space transportation on what we describe as an entirely private entrepreneurial basis." In other words, "We will build our vehicles ourselves and operate them ourselves, selling only the service to all legitimate customers, U.S. and International."

In regard to Arc Technologies' view of its role in commercialization activities, Mr. Bennett pointed out that "we are an ordinary commercial entity providing service to customers in exactly the way any other privately financed, privately developed venture in this country does, and we feel that our relation to the government should be basically that of any other entity interacting with the government only in the regulatory sense". As Arc Technologies will not depend upon the use of government hardware or facilities, the company sees itself as being more independent of public policy decisions than similar competing ventures.

In the process of acquainting government officials with Arc Technologies background and goals, Mr. Bennett went on to report that all initial discussions with government agencies such as NASA and the FAA had "been conducted in a spirit of mutual cooperation and encouragement." Currently, the government is reviewing the company's request to launch an ELV and Mr. Bennett brought to the attention of the Subcommittee some of the general characteristics of the launch approval process.

"We are under the basic jurisdiction of the Department of State in this matter. We are required to get an export permit, temporary export permit, from the Office of Munitions Control of that agency. Since State does not have the in-house capability to judge the public safety aspects of the launch, it was referred for comment to NASA, FAA, and the Department of Defense. We are undergoing a safety review through NASA and the FAA, and we are expecting comments to be returned to the State Department fairly soon, and on that basis the export permit can be issued.

"We also have a permit for the use of the radio frequencies on the part of the FCC; since they have channels in which to deal with developmental permits of this sort, it is not considered to be an extraordinary matter."

Mr. Bennett stated that this process should be modified to accommodate investors and customers. In order for them to "have faith in the availability and predictability of private space transportation, a long-term regulatory structure oriented to commercial business practices must evolve."

Mr. Bennett went on to offer a few general observations and recommendations regarding the licensing system:

1. Regulation of commercial space activities should be kept to the bare minimum required to meet public safety/national security objectives;
2. The Federal Government should reaffirm its commitment concerning the private sector's right to pursue activities in space and should support an even-handed approach to defining impartial, non-burdensome standards for meeting its concerns;
3. Launch service operations should not be required to undergo redundant permit review processes;
4. The government should avoid subsidizing, or in any way unfairly supporting, one launch operator against another;
5. The government should not impose inflexible means for meeting public safety standards;
6. The lead agency should have a mandate to promote space industry, as well as protect the public interest;
7. The lead agency should be granted real preemptive powers to make decisions;
8. Any entity overseeing private launches should be flexible enough to permit innovative approaches to meeting safety standards;
9. Any attempt by the government to define safety standards should be based on the extent to which launch activity poses an undue risk to persons and property not directly involved in the operations.
10. The cost to the launch operator for meeting launch permit review requirements ought not to be unduly burdensome.

Mr. Bennett concluded that Arc Technologies "is part of a growing number of entrepreneurs who have amassed the capital and talent necessary to undertake the risks associated with commercial space development. To date, the Federal Government has been most cooperative and supportive in our efforts to obtain permission to demonstrate our launch technology.

However, routine commercial space transportation operations are ever to become established, the government must create an environment which fosters this nascent business rather than impedes or stifles it. We have suggested ways in which the government's launch approval process might be made more sensitive to the pressing needs of commercial space transportation operators for certainty and predictability."

III. MAJOR ISSUES ADDRESSED IN THE HEARINGS

The purpose of the Subcommittee's hearings was to acquire an understanding of the major issues associated with the commercialization of space. A general overview of the issues was sought and, in addition, more specific topics were addressed, such as the commercialization of expendable launch vehicles and contractual mechanisms that stimulate private/public sector cooperation in space business ventures.

An analysis of the testimony over the four days of hearings shows the emergence of four main issues: (1) Who should be the lead agency responsible for promoting and facilitating space commercialization? (2) Is there a need for new legislation to foster commercialization of space? (3) On what basis should government assets be valued for transfer to, or use by, the private sector? (4) In order to streamline the commercialization process, what institutional, contractual, and organizational changes are required? This Section addresses each of these four issues, and concludes with a discussion of two secondary issues concerning NASA's continuing role in R&D and competition between the public and private sectors.

Who Should be the Lead Agency?

Two aspects quickly emerged from the hearings in regard to the lead agency issue. First, there was no apparent opposition to the idea of having a single agency in government that would act as a focal point for issuing licenses for space commercialization endeavors. Witnesses were in agreement that it is undesirable to have the private sector continually deal with a multiplicity of government agencies and departments.

Second, as Table III-1 demonstrates, there was no consensus as to who the lead agency should be. Congressman Akaka recommended the Department of Commerce on the basis that a new industry is being created and, therefore, "from a philosophic and policy point of view, this industry belongs under the Department of Commerce." NASA, DOD, and the NAPA Panel, whose study was initiated by NASA, declined to recommend a lead agency until after the SIG completed its examination of the issue and made a recommendation. However, the NAPA Panel emphasized the need for NASA to play a lead role in commercialization activities but that it should not perform a regulatory function.

Table III-1. Who should be the Lead Agency?

WITNESS	RECOMMENDATION	COMMENT
Mr. Klutznick Klutznick Investments	None given.	The NAPA Panel did not make a specific recommendation for a lead agency. It was the opinion of the Panel that NASA should play a major part in space commercialization, but should not be the lead regulatory agency.
Mr. Beggs NASA	None given.	Reference was made to the Senior Interagency Group's ongoing study. Mr. Beggs preferred to wait for the results of the study which would include a recommendation for who should be the lead agency.
Mr. Fink NASA Advisory Council	None given.	Was not asked for an opinion.
Mr. Hannah Space Services Inc.	FAA	
Mr. Ordahl McDonnell-Douglas	None given.	Was not asked for an opinion.
Mr. Ferguson Orbital Systems Corp.	None given.	Was not asked for an opinion.
Rep. Akaka	DOC	
Gen. Abrahamson NASA	None given.	Informed the Subcommittee that the State Department had been named the interim lead agency in the May 16, 1983 President's policy directive. He was not ready to suggest who would be designated lead agency on a permanent basis.
Mr. Reynolds Dept. of Defense	None given.	Stated that the SIG was studying the lead agency issues.
Mr. Flora Martin Marietta	Multi-agency group.	Saw no reason to designate an existing agency. Would support the idea of a central group with representatives from existing agencies but is, "quite willing to work with any and all agencies."
Mr. McArtor FEDEX Space Trans. Co.	None given.	Supported the concept of assembling expertise from a variety of agencies to form the nucleus of a group to determine the precise role of government.
Dr. Helss	None given.	Was not asked for an opinion.
Mr. Rector General Dynamics	Open to any agency.	Mr. Rector was asked if he would work with anyone, "State Department, Commerce, FAA, whoever?" He answered, yes.
Mr. Bennett Arc Technologies	DOC	Although not asked specifically for an opinion at the hearing, Mr. Bennett's company subsequently expressed a preference for the Department of Commerce.

After subsequent inquiries, representatives from the major aerospace companies were not prepared to advocate any particular agency. Their collective position seemed to be that they could work with anyone. The small businesses were more ready to make known their positions. Space Services Incorporated of America recommended the Federal Aviation Administration, based on their experience in acquiring a license for the Conestoga launch in September of 1982. "It is the agency, I think, that would be more action-oriented than any other agency," said Mr. Hannah.

The only other business that has had dealings with government agencies in pursuing the acquisition of a launch license, Arc Technologies, recommends the Department of Commerce. As Table III-1 indicates, however, this position was made clear after the hearings and during informal discussions with Subcommittee staff.

The preceding discussion highlights the fact that the question of who should be the lead agency is still an unresolved issue. The Administration is not ready to announce a recommendation and industry, on the whole, is reluctant to enter publicly into the discussion. Only the two small businesses with first-hand knowledge of the licensing process have taken positions, and their opinions differ.

Is There Need For New Legislation?

Pertinent statements made by the witnesses concerning the need for new or amended legislation have been extracted from the testimony and documented in Table III-2. It can be seen from this Table that there is very little support for new legislation. From the Administration's statements, the belief is that the 1958 Space Act provides adequate provision for NASA to encourage space commercialization activities in the private sector. A spokesman for the NAPA Panel concurred with this interpretation.

The NAPA Panel, in its Report that was appended to the transcript of the hearings did caution, however, that the Federal Property and Administrative Services (FPAS) Act may need to be amended in order to provide the authority required to realize continuing public benefits in connection with the disposal of excess and surplus government property. This position by NAPA was not supported by a NASA spokesman who said, "with respect to FPAS, where appropriate procedures do not exist, there is a provision within the FPAS," for the disposal of property.

Table III-2. Is there need for new legislation?

WITNESS	RESPONSE	COMMENT
Mr. Klutznick NASA	Uncertain,	In response to Congressman Walker's question regarding a need to amend NASA's organic act, Mr. Klutznick responded that the Panel did not "go into that." However, Mr. Mossinghoff commented that, "there are several areas in the [1958 Space Act] where clearly the Act envisioned the kinds of activities that are recommended in the Panel's report."
Mr. Beggs NASA	No.	Mr. Beggs made it clear under questioning that in his opinion, "we have ample authority under the 1958 Space Act, as amended, to move out on those opportunities." The opportunities referred to included, "expandable launch vehicles and possibly other things," suggested by Mr. Volkmer.
Mr. Fink NASA Advisory Council	No.	Mr. Fink stated that he did not necessarily see the need for legislation, but, "I am sure there is going to be an oversight responsibility that Congress will want to continue to exercise."
Mr. Hannah Space Services Inc.	None given.	Mr. Hannah was not asked whether there was a need for further legislation. However, his written testimony addressed three areas where the government could help by: (1) designating a lead agency and developing a clear-cut regulatory path, (2) not subsidizing programs that compete with the private sector, and (3) continuing to make the results of research available to industry. The need for new legislation in connection with these three areas was not discussed.
Mr. Ordahl McDonnell-Douglas	None given.	The question of new legislation was not addressed directly to Mr. Ordahl.
Mr. Ferguson Orbital Systems Corp.	None given.	The question of new legislation was not addressed to Mr. Ferguson.
Rep. Akaka	Yes.	Congressman Akaka introduced H.R. 1011, the Space Commerce Act.
Gen. Abrahamson NASA	No.	General Abrahamson testified that he does not see the need for legislation or amendments to the Federal Property and Administration Services Act.
Mr. Reynolds DOD	None given.	The question of new legislation was not addressed to Mr. Reynolds.
Mr. Flora Martin Marietta	No.	In his prepared testimony, Mr. Flora stated that, "our [Martin Marietta] legal staff has found that existing legislation appears adequate."

On What Basis Should Government Assets Be Valued
For Transfer To, Or Use By, The Private Sector?

The question of how to value assets is complicated by the several different types of asset involved. For example, residual inventories of parts and components that are ready for their first use, do not fall into the same category as used tooling and test equipment. There are also distinctions to be made between valuing government services and facilities, and assessing intangibles such as government designs for space hardware.

In spite of these definitional difficulties a consensus emerged among the witnesses, as shown in Table III-3. In regard to inventories, the Administration's position is that they should be sold at a price that is based on their cost to the government, while tooling and test equipment should be based on market value. Martin Marietta's testimony indicates that this approach is equitable because, in negotiations with the Air Force, formulas are being developed that are based on acquisition costs and depreciation.

Table III-3. On what basis should government assets be valued?

WITNESS	RESPONSE
Mr. Klutznick Klutznick Investments	It was concluded by the NAPA Panel that, once program objectives have been achieved, or a facility has served its intended purpose, "the Federal Government's estimate of the currently remaining value of its assets should be determined by their worth in the marketplace, not by what the historical costs may have been to produce them."
Mr. Beggs NASA	Inventories "ought to be sold at cost, whatever the government cost in them is." Tooling and test equipment should be based on market value.
Mr. Fink NASA Advisory Council	Mr. Fink believes that government negotiators have been rightly trained to try and extract the most value for the use of a government facility. He went on to say, "If we are trying to encourage the use of the facility that would otherwise be mothballed or scrapped, perhaps that attitude has to change."
Mr. Hannah Space Services Inc.	Mr. Hannah believes that the government should be reimbursed for any service it provides on an "added cost" basis.
Mr. Ordahl McDonnell-Douglas	It should be possible to establish a value to tangible assets. Price stability and uniformity are key factors.
Mr. Ferguson Orbital Systems Corp.	Not asked to respond.
Rep. Akaka U.S. House of Representatives	Not asked to respond.
Gen. Abrahamson NASA	Should be a mixture of government costing and fair market-value applied appropriately to the different segments of the facilities and assets involved.
Mr. Reynolds Department of Defense	Cost recovery for services should be based on additional costs incurred by the government. The government should not seek to recover design and development costs, and tooling, equipment and residual hardware should be priced in the best overall interest of the government.
Mr. Flora Martin Marietta	Martin Marietta is negotiating formulas with the Air Force that are based on acquisition costs and depreciation for residual hardware and facilities.
Mr. McArthur FEDEX Space Transportation Company	Confirmed Mr. Flora's testimony.
Dr. Heiss Space Transportation, Inc.	Not asked to respond.
Mr. Rector General Dynamics	The government should be reimbursed for, "added costs incurred in support of commercial operations from U.S. Government facilities."
Mr. Bennett Arc Technologies	Not asked to respond.

Several witnesses echoed the need to base residual hardware cost on market-value. The significance of this approach is that the government should not attempt to recover sunk research and development costs. As Mr. Klutznick stated, "the Federal Government's estimate of the currently remaining value of its assets should be determined by their worth in the marketplace, not by what the historical costs may have been to produce them."

When considering the pricing of government services such as providing personnel for launch tracking, there was a common belief that these services should be reimbursed by industry on an "added cost" basis. In this context these costs would be those incurred by the government over and above the government's normal costs for staffing the facilities. Again, this is seen as applying only those costs directly associated with the added task, with no factors apportioned in an attempt to recoup the sunk costs of the operation.

When pricing the use of a government facility such as a launch pad, this should also be treated on an added-cost basis for government support personnel. Other key factors in pricing this type of facility are price stability and price uniformity. With these guarantees, industry would have a firm understanding of future prices for planning purposes and fair competition would result.

To summarize, witnesses who responded to the question of how government assets should be valued, indicated that: inventories should be based on acquisition costs; tooling and test equipment should be based on market value, taking into account acquisition costs and depreciation; and services and facilities should be priced on added costs. There was a consensus that the government should not attempt to recover sunk research and development costs.

In Order To Streamline The Commercialization Process, What Institutional Contractual And Organizational Changes Are Required?

The organizational changes related to the commercialization process fall into two categories. (1) Those changes to streamline commercialization of technologies in generally developed by NASA, and (2) the commercialization of ELV's. In the case of the ELVs the streamlining of the commercialization process is inevitably tied to the lead agency and the legislation issues discussed above. Assuming the establishment of a lead agency and a set of procedures and regulations laid out by the Administration, what other structural changes should be made, if any? This question was considered within the overall context of the streamlining of the commercialization process within NASA, and by addressing the issues of: the need for reorganization within NASA; the viability of existing public/private sector contractual instruments such as the Joint Endeavor Agreement (JEA); and how to encourage participation by non-aerospace firms in commercial space ventures. These issues are discussed below.

a. Need For NASA To Institute Organizational Changes

The NAPA Panel did not recommend a major reorganization of NASA. It did suggest, however, that NASA make, "a clear statement of senior management commitment and a positive program in support of commercialization as a policy compatible with the long-run future of NASA." Then, NASA should establish a focal point near the top of its organization to, "gradually pull together appropriate organizational elements, building a cohesive unit as the agency moves ahead with its commercial role."

Mr. Beggs generally agreed with the NAPA Panel's recommendations and stated his intention to examine where a commercial entity should fit in the NASA organization. He was in complete agreement that, "we have got to set up a single focal point where businessmen and entrepreneurs who have an idea can come and pursue it without having to work through the chain of the organization."

The idea of a commercialization office within NASA was also supported by industry. Mr. Hannah said that SSI had dealt with many different people in NASA in pursuing their commercial launch activities and expressed the opinion that a focal point within NASA, "would be consistent with our concept of trying to streamline the process."

It appears from the testimony that a space commercialization office reporting into the higher levels of NASA would achieve at least two beneficial objectives: it would be an explicit declaration of NASA's commitment to commercial space endeavors, and it would provide a focal point for commercialization activities within NASA that would help streamline the process of converting a commercial idea into reality.

b. The Viability of Existing Contractual Instruments

NASA has developed three basic types of agreements that are used to encourage private organizations to participate jointly with NASA in space activities. The most substantive type from the viewpoint of near-term commercial activities is the JEA. This is a cooperative arrangement in which private participants and NASA share common program objectives, program responsibilities, and financial risk. On a different level, NASA uses a Technical Exchange Agreement (TEA). Under a TEA, NASA and a company agree to exchange technical information and cooperate in the conduct and analysis of ground-based programs. An Industrial Guest Investigator (IGI) agreement provides for collaboration between scientists from the private sector and NASA in an experiment of mutual interest. In all cases, NASA does not fund any of the work performed by the private sector.

In the opinion of the NAPA Panel, NASA should expand its use of TEA and IGI arrangements to promote exchange of information between industry and NASA. Also, NASA should make the fullest possible use of the JEA. One interesting aspect of the JEA between NASA and Orbital Systems Corporation (OSC) is that NASA has agreed not to fund a competing program. This provides assurance to OSC that any competitors entering the field will not be under contract to NASA. This particular JEA also sets agreed-to reliability goals, but precludes NASA from any future re-direction of these goals.

This latter point concerning reliability can prove troublesome in some instances. This was the case, apparently, with the Payload Assist Module-D (PAM-D) program that McDonnell Douglas negotiated with NASA. The costs of developing and producing PAM-D remained completely with McDonnell Douglas, but the extent of NASA's technical direction of the program had to be resolved. To arrive at an equitable Technical Monitoring Agreement, which is a further, low-level agreement mechanism, NASA's oversight responsibilities had to be defined. Basically, the areas of conflict that emerged were centered on reliability and quality assurance issues. McDonnell Douglas'

approach was that once Shuttle integration and Shuttle and astronaut safety provisions were met, the reliability and quality assurance of the PAM-D should be the responsibility of the manufacturer. As Mr. Ordahl pointed out in his testimony, "Once it leaves the Shuttle it is on its own; it was bought and paid for by industry."

From the foregoing discussion, it is apparent that there are existing contractual instruments designed to encourage joint NASA and private sector space ventures. As a minimum, industry appears to require a large amount of autonomy in setting its own reliability and quality standards, and is seeking assurances that the government will not enter into direct competition, or provide funding to other organizations for them to pursue competing systems.

c. Encouragement Of Non-aerospace Firms To Participate In Space Ventures

The NAPA Panel sees the need to educate industry in space technologies and to encourage industry participation in commercial initiatives. In Mr. Klutznick's prepared testimony he stated, "Industry, particularly non-aerospace companies that daily produce goods and services for domestic and international markets, has to be made aware of the potential of space technology." In the Panel's opinion, both the TEA and IGI arrangements address this need. However, is this enough?

Under questioning, Mr. Klutznick offered the opinion that opportunities for space commercialization should be promoted and that it would be advantageous to make people aware of potential opportunities. NASA should develop a knowledge base that it transfers to small, medium and large businesses.

Mr. Beggs recognized the need to communicate with industry and said, "We are going to try and enhance and improve our ability to disseminate information to the non-aerospace sector, as well as to make them more aware from time to time of the opportunities that are available through the Shuttle."

In turn, the dissemination of information on space technologies may well stimulate "commercialization pull" referred to in Mr. Fink's testimony. This is a condition in which the private sector is initiating activity and the government is gearing to respond. Mr. Fink agreed that the government had a responsibility to at least prod and educate in order for commercialization pull to be effected.

Overall, the underlying factors that would most likely benefit non-aerospace business in undertaking space ventures are: the designation of a lead agency; an identifiable commercialization focal point in the NASA organization; and a more concerted effort by NASA to educate non-aerospace businesses in aerospace technologies.

Other Issues

Throughout the hearings there were two recurring questions: Should NASA continue to do R&D in areas of space technology that have been commercialized? And, to what extent will the commercial enterprises compete with NASA's activities? A discussion of these concerns follows.

a. Role of NASA In R&D

There appeared to be general agreement among the witnesses that NASA should continue R&D in all areas of space technology regardless of the degree to which the technologies are being commercially applied. The most telling endorsement for this opinion was given in the NAPA testimony:

The panel believes that a commercialization role does not diminish the NASA R&D role. It strengthens it and provides additional challenges. NASA is the basic source of space technology, space systems, and knowledge of the space environment, all of which are essential to support commercial endeavors in space. While industry excels in exploiting and marketing current technology, it often does not have the resources to undertake the high risk, long-term advanced developments necessary to maintain a leadership posture in an increasingly competitive industrial market.

The Panel testimony went on to emphasize the point that the concurrent NASA R&D role and commercialization activities support national goals and provide economic benefits. This view was supported by Mr. Fink who pointed out that NASA is still involved in aeronautical research and development and said, "there is a case where we have a commercial field in which the government continues to participate."

To summarize the tone of the opinions expressed on the subject of continuing NASA involvement in R&D, it may be concluded that R&D is seen as NASA's forte and primary role. Mr. Hannah, for example, explained how NASA had been tremendously helpful in passing on the results of research to SSI, and expressed the hope that this attitude toward technology transfer would prevail in the future. He sees industry playing an operational role.

b. Competitive Forces Between Government and Industry

One concern over private/public sector competition was whether commercial expendable launch vehicles will provide a threat to the Shuttle. On the other hand, industry is concerned that government subsidized Shuttle launches will jeopardize private launch services.

Mr. Beggs sees a potential competitive situation in the long-term but no immediate impact from commercializing expendable launch vehicles. He said,

For the next five years we are going to be primarily fighting a case in the marketplace of being limited by our flight rate rather than by the market. After five years, it is conceivable that we will have a competitive situation develop as between Shuttle and the expendables. And, if we do, then it will be a question of who can supply the most effective service at the best price in the marketplace.

Under questioning from Congressman Nelson, Mr. Beggs expressed the view that it was important to build up the flight rate of the Shuttle fleet to an interim target of 24 per year in order to realize launch cost savings. For this reason, he thought that it would not be a good policy to maintain expendables indefinitely. Under further questioning, Mr. Beggs said that he thought a four-shuttle fleet could handle 24 flights per year, "absent an accident or a loss of an orbiter." However, a launch rate of 40 per year would probably require a fleet of six orbiters.

The industry viewpoint was that all expendables would be complementary to the Shuttle and would not compete with it. Some basis for this opinion is that few commercial payload companies are prepared to commit their payloads solely to a Shuttle launch at this time because of uncertainties in the launch schedule. As a contingency, these same companies book on an ELV in addition to the Shuttle. At present, the French Ariane launch vehicle offers a convenient backup source. The U.S. companies see themselves competing with Ariane rather than the Shuttle.

Dr. Helss does not see the Shuttle and U.S. commercial ELVs engaged in direct competition with each other. Instead, he sees both sides gaining over foreign competition. He believes that without a U.S. backup to the Shuttle, "we will become a marketing entity in the United States for foreign expendable backups." To be certain of a specific launch date, commercial payload operators, who may be committing half a billion dollars to the payload, will have to invest in an ELV backup.

It was revealed by the private sector witnesses that guaranteeing a specific launch date was their strength. With the present Shuttle pricing policy, they can not compete on a price basis. However, government subsidization of Shuttle launches could provide a competitive threat to ELVs if adopted in future pricing policy revisions. This appears to substantiate Mr. Beggs' opinion that there is no near-term competition between Shuttle and U.S. ELVs. Competition may arise in the future, however, if the Shuttle launch schedule is shown to be reliable and Shuttle launches are government subsidized.

IV. CONCLUSIONS AND RECOMMENDATIONS

After reviewing the testimony and analyzing the issues discussed in the previous Sections, the following conclusions and recommendations are offered by the Subcommittee:

Conclusion No. 1

A lead agency should be named for the purpose of acting as a focal point in government for coordinating and facilitating commercial space endeavors. This would help to streamline the process of issuing commercial licenses to private sector organizations. The question of which agency should be given the lead role for this function remains an open issue.

Conclusion No. 2

There is no clearly defined need for new legislative authority in order to proceed with space commercialization ventures. However, legislation that defines the responsibilities and authority of a lead agency and provides direction for both government and industry would be very helpful.

Recommendation: The Subcommittee should continue review of H.R. 1011, "the Space Commerce Act" for the purpose of incorporating suggestions made in the hearings and amend the Bill as appropriate.

Conclusion No. 3

When providing services or transferring property to the private sector, the government should not attempt to recoup its total investment costs. The value of assets associated with ELV launches depends on their commercial value, and perhaps the income they can generate. Therefore, it seems appropriate for the private sector to pay a fee for use of government assets utilized in ELV launches commensurate with the prevailing market value of those assets.

Recommendation: For the purpose of use by, or transfer to, the private sector, Government assets should be valued as follows:

- (a) Inventories should be based on their prevailing market value.
- (b) Tooling and test equipment should be based on market value taking into account acquisition costs and depreciation.
- (c) Services and facilities should be priced to recoup costs incurred beyond those normally realized from government operations which result from making Government services and facilities available to the private sector.

Conclusion No. 4

A space commercialization office is needed within NASA's organizational structure to provide a focal point in communicating space technological information to non-aerospace firms and in facilitating space commercialization activities.

Recommendation: NASA should establish a commercialization office reporting to the Administrator with the authority and direction necessary to ensure effective facilitation of space commercialization activities.

Conclusion No. 5

Existing contractual mechanisms such as the Joint Endeavor Agreement (JEA), Technical Exchange Agreement (TEA), and Industrial Guest Investigator (IGI), are effective instruments for encouraging the private sector to join with NASA in pursuing space activities.

Conclusion No. 6

NASA should not discontinue R&D effort in any area that industry has assumed a dominant operational role. Instead, NASA should maintain a continuing R&D role whenever it is in the national interest.

